THE PACE OF BEHAVIOUR CHANGE AND IMPLICATIONS FOR TDM RESPONSE LAGS AND MONITORING: FINDINGS OF A RETROSPECTIVE COMMUTER TRAVEL SURVEY IN CAPE TOWN

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ABSTRACT

This paper discusses the findings of a retrospective travel survey conducted in Cape Town during 2006 with respect to the pace at which change in commuter travel behaviour occurs. Data were collected in four residential areas in which a large portion of households fall within the R3,000-R6,000 income band, observed in other data sources as strategic from a car ownership and mode switching perspective. The paper identifies the different elements of a commuting trip decision as origin, departure time, mode, route (if private transport), vehicle occupancy (if private transport), and destination. It discusses the findings of the survey with respect to the distribution of time elapsed since change in usual behaviour for each of these trip decision elements, as well as with respect to the distribution of time elapsed since change in usual behaviour has been considered but not acted upon. The paper concludes with a discussion on the implications of these findings for understanding possible behavioural response lags following TDM intervention, and for appropriate timeframes for TDM strategy monitoring and revision.

1. INTRODUCTION

The *National Land Transport Transition Act* (22 of 2000) requires the formulation of 'general strategies on travel demand management' (TDM) as part of each planning authority's statutorily required Integrated Transport Plan. This paper discusses the findings of a retrospective travel survey conducted in Cape Town during August 2006, as part of a project commissioned by the Department of Transport to develop a strategic framework to guide the implementation of such TDM strategies.[1] The aim of the paper is to report upon findings with respect to the pace at which survey respondents change different elements of their commute travel behaviour, and the pace at which commuters consider change, even if they do not act upon it. Insight into these issues has important implications for anticipating the timeframes within which the full impacts of TDM strategies occur. It is posited that travel choices are not made deliberately every day; that travel choices, if proven in past experiences to be of benefit or at least satisfactory to the traveller, become habitual; and that travel habits are typically broken when some form of 'life shock' or 'life

[1] The permission of the Department of Transport to publish the findings of this project are gratefully acknowledged.

event' occurs which forces a reappraisal of the habit and leads to an alternative deliberate habit-forming decision (see, for instance, Behrens and Del Mistro 2006, Fujii and Gärling 2003 and Gärling and Axhausen 2003 for a fuller discussion on the notion of travel as 'habitual' behaviour). The paper is divided into four sections. The next section briefly describes the survey undertaken. Section 3 discusses survey findings, and section 4 concludes with an examination of implications for TDM strategy implementation.

2. SURVEY METHOD

Because of Cape Town's greater public transport mode share, compared with that of Gauteng, and because it was postulated that past experience of public transport amongst car users was probably greater than in Gauteng, Cape Town was selected for the implementation of the survey. National Household Travel Survey and Census 2001 data were interrogated to find areas where there was a relatively large proportion of households in the car-owning or 'car-aspirant' income group (identified as R3,000-R6,000/month), with the purpose of increasing the possibility of interviewing persons using private transport to travel to work, but with a memory of using public transport. Another criterion was that the sampling areas selected should be well-served by public transport. Selected characteristics of the survey sample are presented in table 1.

Table 1. Selected survey sample characteristics (n=250p)

Race	Black	Coloured	Indian	White	
	83	153	7	7	
Income	< R3 000/m	R3 001 – R4 000/m	R4 001 – R5 000/m	R5 001 – R6 000/m	> R6 000/m
	31	36	37	48	98
Car availability	0 vehicles	1 vehicle	2+ vehicles		
	107	88	55		
Gender	Male	Female			
	125	125			
Age	18 – 24 years	25 – 34 years	35 – 44 years	45+ years	
	38	69	62	81	
Residential area	Wynberg/ Plumstead	Steenberg	Gugulethu/ Mandalay/ Mont Claire		
	83	83	84		

The survey was administered through computer-assisted personal interviews (CAPI) in the home. In each of the 250 randomly selected households, one worker aged between 18 and 65 years who regularly travelled to work, was interviewed. Interviewers used a Politz grid to ensure that both genders and all age groups were represented. The CAPI interview transcript was an extension and refinement of an earlier experimental retrospective survey questionnaire (see Behrens and Del Mistro 2006). In essence, respondents were asked to record when they last changed behaviour, or considered changing, and to explain the circumstances that led to this.

3. SURVEY FINDINGS

The survey findings presented here are restricted to two groups of questions relating to, firstly, the pace at which commuters change their travel behaviour in the absence of targeted TDM measures influencing their choices, and, secondly, in the case of commuters who have never changed behaviour, the pace at which change is considered but not acted upon. Behaviour change is discussed in terms of the different elements of a commuting trip decision, identified as: origin, departure time, mode, route (if private transport), vehicle occupancy (if private transport), and destination.[2]

It is argued that moments of actual or considered change represent windows of opportunity within which individual commuters can be influenced to make decisions that align with TDM strategy objectives. For instance, if it is known that commuters tend to reconsider their mode use especially when they change residence or job location, then successful TDM programmes might especially target new residents or new employees in an area. Therefore, understanding the frequency of these moments with respect to the different commute decision elements provides an important indication of the timeframe over which the impacts of TDM inventions aimed at particular commute decisions are likely to be observed, and will provide insight into how habitual commuting behaviour is within the passenger market segment(s) covered in the survey.

3.1 Actual change across commute decision elements

Table 2 indicates that a large portion of the sample population indicated that they had never changed their behaviour with respect to the different elements of the trip decision: 50% in the case of trip origin, 31% in the case of trip destination, 73% in the case of departure time, 62% in the case of mode, 12% in the case of route (if a car driver), and 82% in the case of lift club participation. The high percentage of respondents who indicated that they have never changed departure time is surprising. Both local and international studies of 'churning' morning peak traffic streams (see, for example, Del Mistro and Behrens 2006, Cherrett and McDonald 2002) indicate that commuters vary departure time frequently – both studies, for instance, found that in the region of 50% of vehicles are not observed in the same traffic stream in the same time period on the following weekday. It is, however, probably because departure times are so volatile that the survey findings on the frequency of change in 'usual' departure time are lower than expected. It is likely that respondents who vary their commute departure time regularly – in a question that asked when they last changed their 'usual' departure time 'give or take 10 minutes, apart from changes now and then' – found 'usual' difficult to interpret, and therefore found this question difficult to answer. The 12% of car drivers found to have never changed their route choice is more consistent with the findings of these 'churn' studies.

[2] Findings related to what triggers change in commuter travel behaviour are presented in a companion paper (see Del Mistro *et al* 2007).

Table 2. Time elapsed since change in usual behaviour, by (home to work) commute decision element (percentage) (2006, n=250p)

	Within the past month	2-3 months ago	4-6 months ago	7-12 months ago	1-2 years ago	3-5 years ago	6-10 years ago	11-15 years ago	16-20 years ago	21-25 years ago	More than 25 years ago	Never changed	Cannot remember	Total
trip origin	0.4	3.6	2.4	1.6	5.6	12.8	7.2	6.0	5.2	4.0	1.6	49.6	0.0	100
trip destination	2.8	3.2	3.6	8.0	13.6	14.4	11.2	5.6	1.6	2.8	2.4	30.8	0.0	100
departure time	2.0	1.6	1.6	3.2	7.2	4.0	4.4	2.4	0.0	0.4	0.0	72.8	0.4	100
mode	1.6	2.4	2.0	3.2	8.8	8.8	6.8	2.0	1.6	0.8	0.4	61.6	0.0	100
route (if car driver)	1.4	6.8	4.1	5.4	16.2	32.4	12.2	2.7	2.7	2.7	1.4	12.2	0.0	100
lift club (if car user)	1.1	0.0	1.1	0.0	5.3	3.2	5.3	1.1	0.0	0.0	0.0	81.9	1.1	100

Table 3 focuses on only respondents who indicated that they had changed usual behaviour, and excludes those who either have not changed or cannot remember when they last changed. Figure 1 presents these data as a percentage distribution. The table indicates that past lift club participation is low, and therefore percentage distributions over time should be treated with caution. Figure 1 indicates clearly that in all categories of trip decision, most changes in behaviour have occurred within the previous 5 years. No significant differences in temporal profile are observable.

Table 3. Time elapsed since change in usual behaviour in five year intervals, by (home to work) commute decision element (count) (2006, n=250p)

	0-5 years ago	6-10 years ago	11-15 years ago	16-20 years ago	21-25 years ago	> 25 years ago	Total
trip origin	66	18	15	13	10	4	126
trip destination	114	28	14	4	7	6	173
departure time	49	11	6	0	1	0	67
mode	67	17	5	4	2	1	96
route (if car driver)	49	9	2	2	2	1	65
lift club (if car user)	10	5	1	0	0	0	16

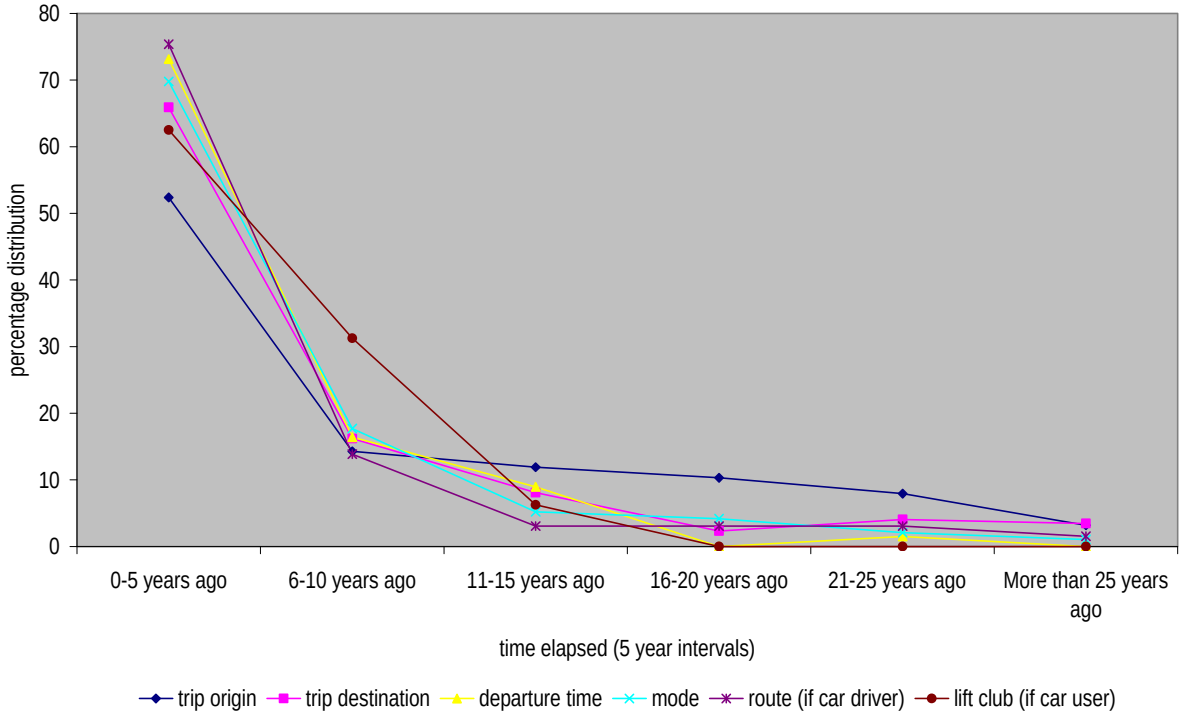

Figure 1. Time elapsed since change in usual behaviour in five year intervals, by (home to work) commute decision element (percentage) (2006, n=250p)

Figure 2 then expands time intervals to include a greater disaggregation of intervals in the '0-5 years ago' category. The figure illustrates a surprising similarity of pace of change profiles across all trip decision elements. This similarity is unexpected, and inconsistent with 'least effort' theoretical explanations of behavioural change aligned to conceptualisations of travel as habitual behaviour, which posit that when travellers are presented with a need to change behaviour, they experiment with least cost or effort change first (in the form of timing or route adaptations), and if these do not satisfy requirements, they then explore greater cost or effort changes (in the form of mode or destination changes) until a satisfactory travel pattern is arrived upon. Thus departure time and route choice behaviours were expected to have been changed more recently, as compared to the other decision elements, by a greater portion of the sample. As discussed above, the counterintuitive finding reported here is explained by likely difficulties respondents had in identifying 'usual' behaviour, and changes in their 'usual' behaviour, in the content of volatile departure time and route choice patterns. The expected pace of change profile, drawn from the earlier retrospective survey experiment in Cape Town (Behrens and Del Mistro 2006), is illustrated in figure 3 – it should be noted that in this survey respondents were simply asked to recall the last time they changed behaviour, without the more detailed specification of change of 'usual behaviour apart from changes now and then'.

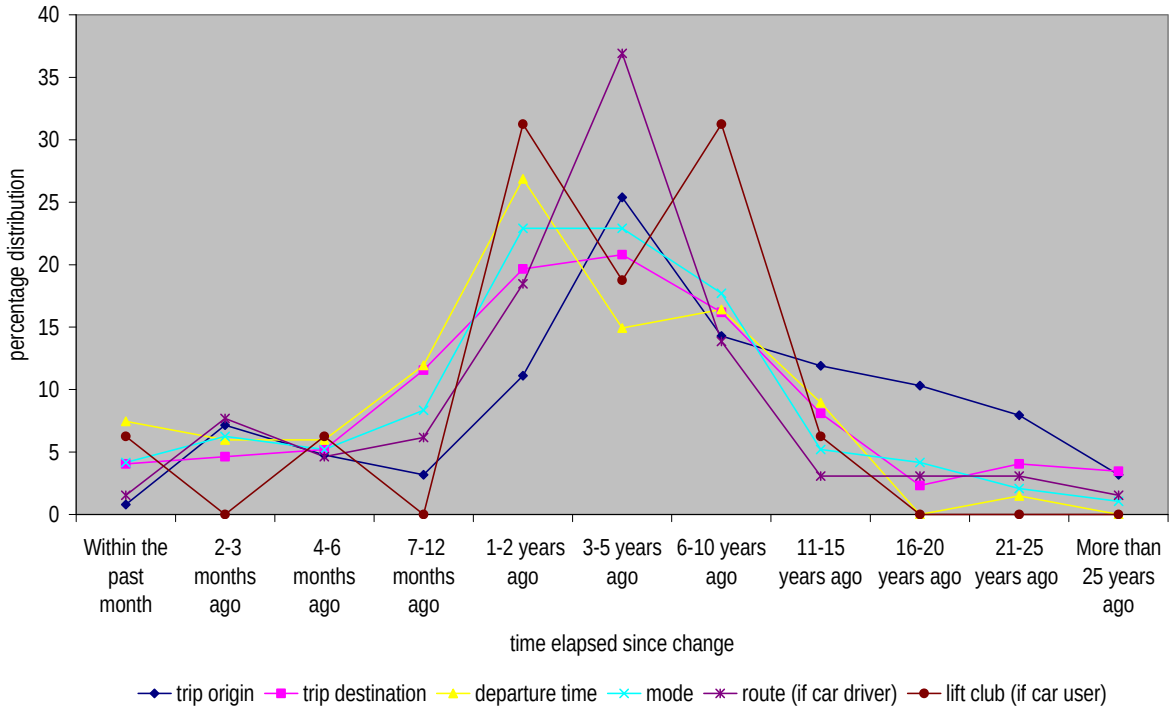

Figure 2. Time elapsed since change in usual behaviour, by (home to work) commute decision element (percentage) (2006, n=250p)

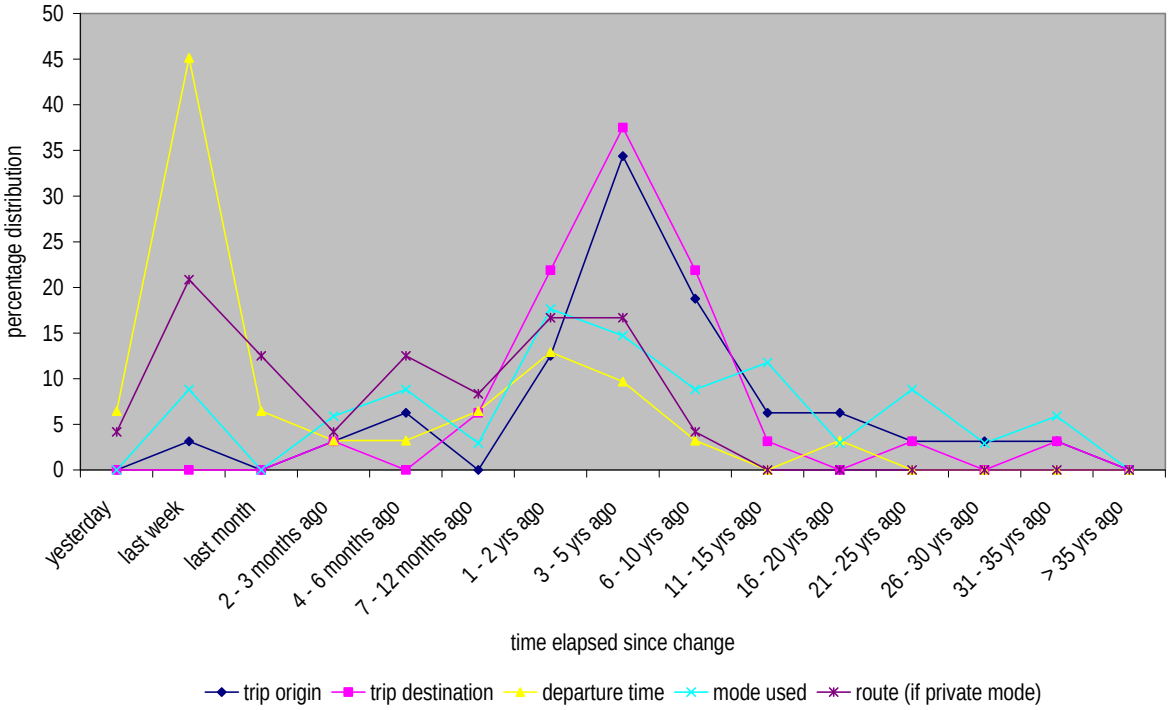

Figure 3. Time elapsed since the most recent behavioural change, by travel choice component (n=40, except for route selection where n=20) (Ghoor 2005)

Operating on the very crude assumptions that the *rate* of change is constant across the entire sample population (i.e. that every day/week/month the same number of people change behaviour) and that the *frequency* of change is also constant (i.e. that the amount of time between changes in behaviour remains constant over time), figure 4 presents a form of 'half-life' analysis in which a doubling of the 'time elapsed since change' value provides a very rough indication of the pace at which change is happening. These

assumptions result in a symmetrical pattern of time elapsed between behavioural changes. Figure 5 illustrates this diagrammatically. In essence, it is assumed that the mean of the 'time elapsed since change' values recorded in the survey are half the mean frequency of behaviour changes. Therefore it is possible that the mean interval between changes in usual commute mode is around 10 years, and in usual commuter trip destination is around 12 years, and so on. While the assumptions underlying these estimates are problematic in numerous ways, such an analysis does provide some insight into how often usual commute behaviour changes in the absence of direct TDM intervention, and corroborates the notion that commuter behaviour is enduring and habitual in nature.

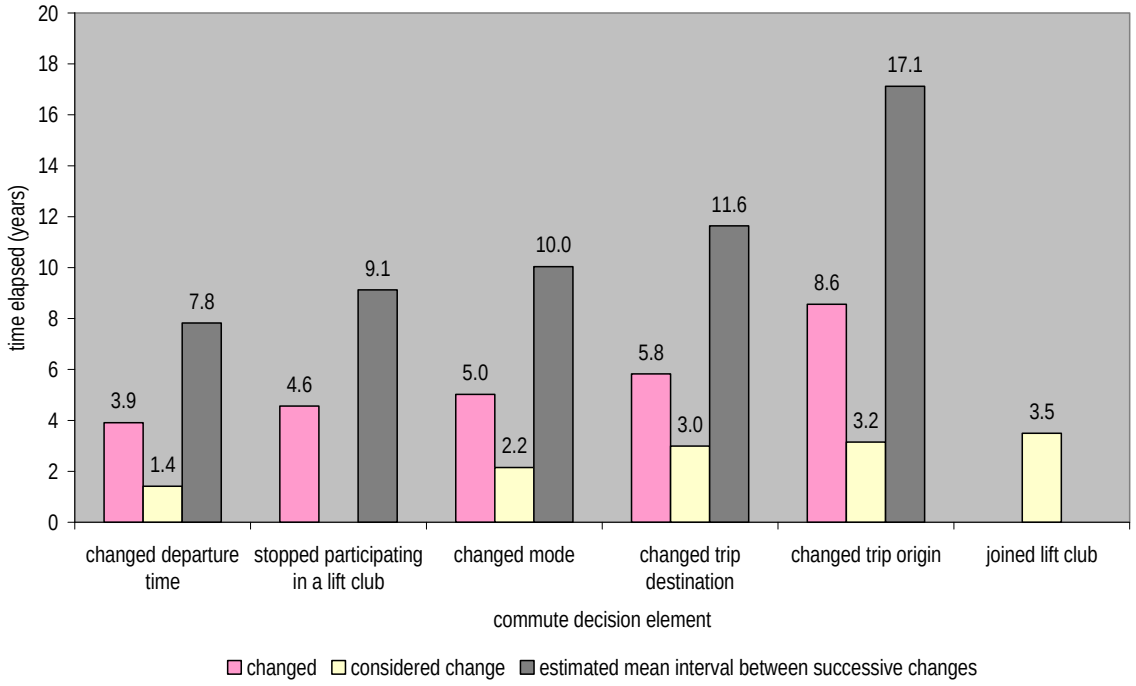

Figure 4. Mean time elapsed since change in usual behaviour, by (home to work) commute decision element (years) (2006, n=250p)

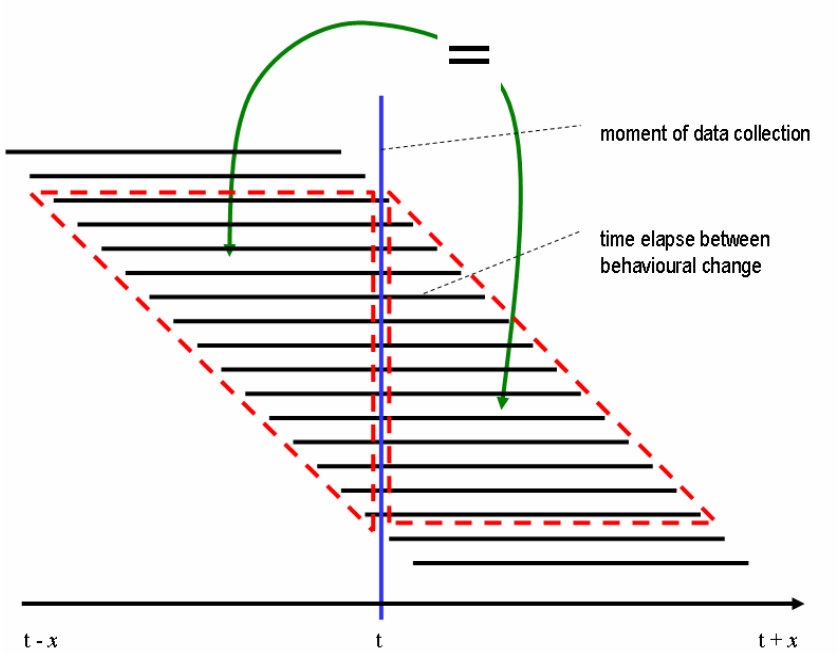

Figure 5. Diagrammatic illustration of the 'half-life' analysis concept

In figure 4, no data were available to calculate ‘considered change of origin’, all the ‘considered change’ data include ‘actual change’ since change only occurs after it is considered, and the lift club data had too few responses to be used. The mean interval between change values were derived as twice the weighted mean of the times reported by the respondents based on the mean value of the time categories. The mean values of time categories are assumed to be the mid-point (e.g. 48 months in the case of the ‘3-5 years’ category). For the category of ‘less than a month’ the mean was taken as a ½ month, and for the category ‘more than 25 years’ the value was taken as 300 months. A limit in this, and subsequent, analysis of ‘considered change’ is that respondents who recorded that they had previously considered changing behaviour are limited to those who indicated that they had never before changed the particular travel behaviour being questioned. It is possible, if not likely, that frequency of ‘considered change’ amongst a traveller population that has never before changed behaviour, is not typical of the frequency of ‘considered change’ amongst a traveller population that has changed. The data findings presented on the frequency of ‘considered change’ are, therefore, likely to be conservative.

3.2 Considered change amongst ‘no change’ respondents across commute decision elements

Table 4 and figures 6 and 7 mirror the above analysis for respondents who indicated that they had never changed their usual behaviour with respect to the different commute decision elements (excluding route choice as the survey omitted this question). Comparison of table 3 and figure 1 with table 4 and figure 6 indicate that consideration of change is more concentrated within the previous five years than in the case of ‘actual change’. Between 85-94% of ‘considered changes’ occurred within the previous five years (compared to between 52-75% in the case of ‘actual changes’).

Table 4 Time elapsed since change in usual behaviour considered amongst 'no change' population in five year intervals, by (home to work) commute decision element (count) (2006, n=250p)

	0-5 years ago	6-10 years ago	11-15 years ago	16-20 years ago	21-25 years ago	> 25 years ago	Total
trip origin	71	5	3	2	1	1	83
trip destination	63	7	2	1	0	1	74
departure time	51	3	0	0	0	0	54
mode	77	4	2	0	1	0	84
lift club (if car user)	13	0	1	0	0	0	14

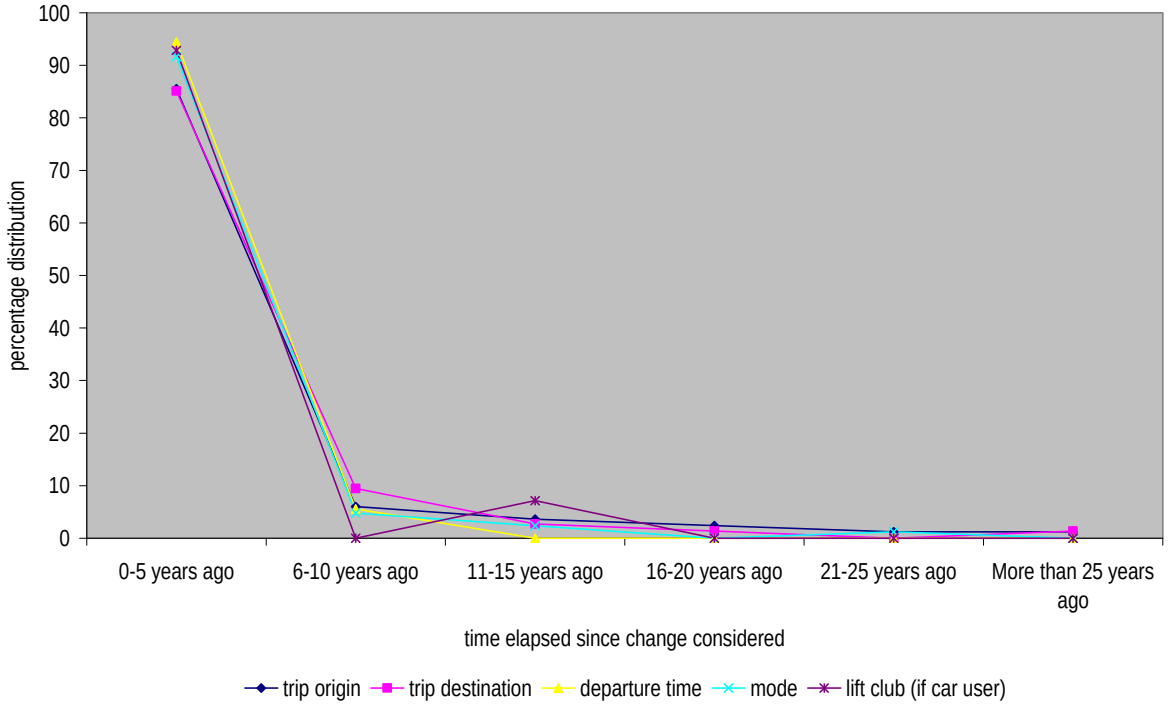

Figure 6. Time elapsed since change in usual behaviour considered amongst 'no change' population in five year intervals, by (home to work) commute decision element (percentage) (2006, n=250p)

Figure 7 expands time intervals within the '0-5 years ago' category. Comparison with figure 2 illustrates greater differentiation in the more recent past (i.e. within the previous six months). Figure 8 compares the distribution of 'actual' and 'considered change' within the previous six months, illustrating a greater proportion in this time segment amongst the 'no change' respondent population, and suggesting that consideration of change occurs more frequently than actual change.

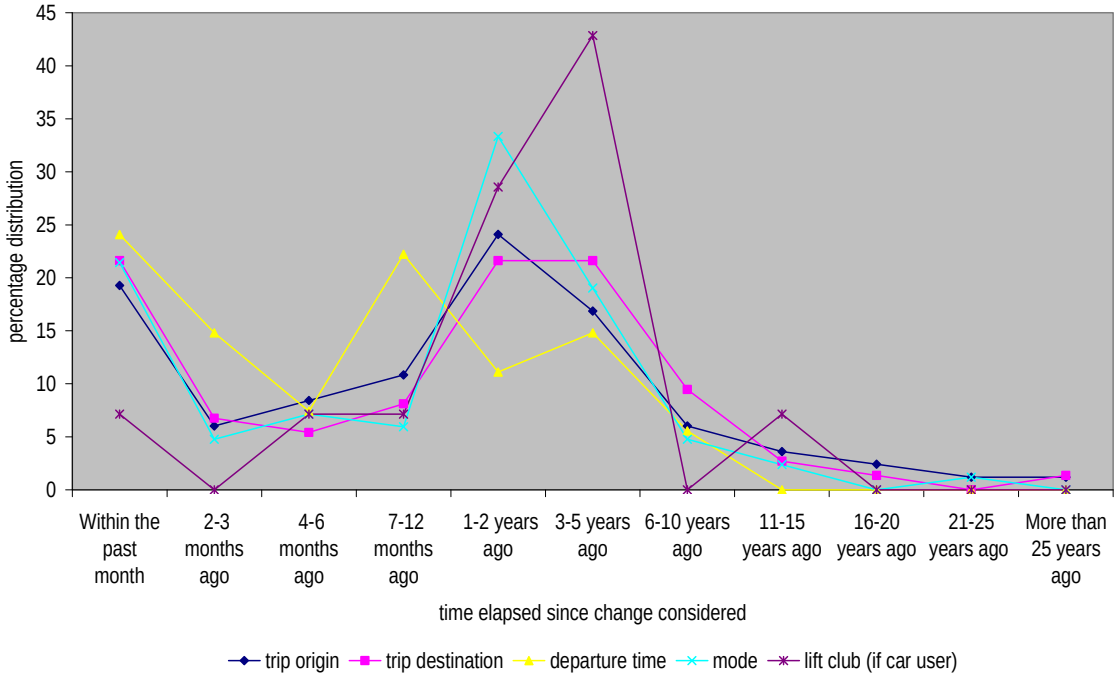

Figure 7: Time elapsed since change in usual behaviour considered amongst 'no change' population, by (home to work) commute decision element (percentage) (2006, n=250p)

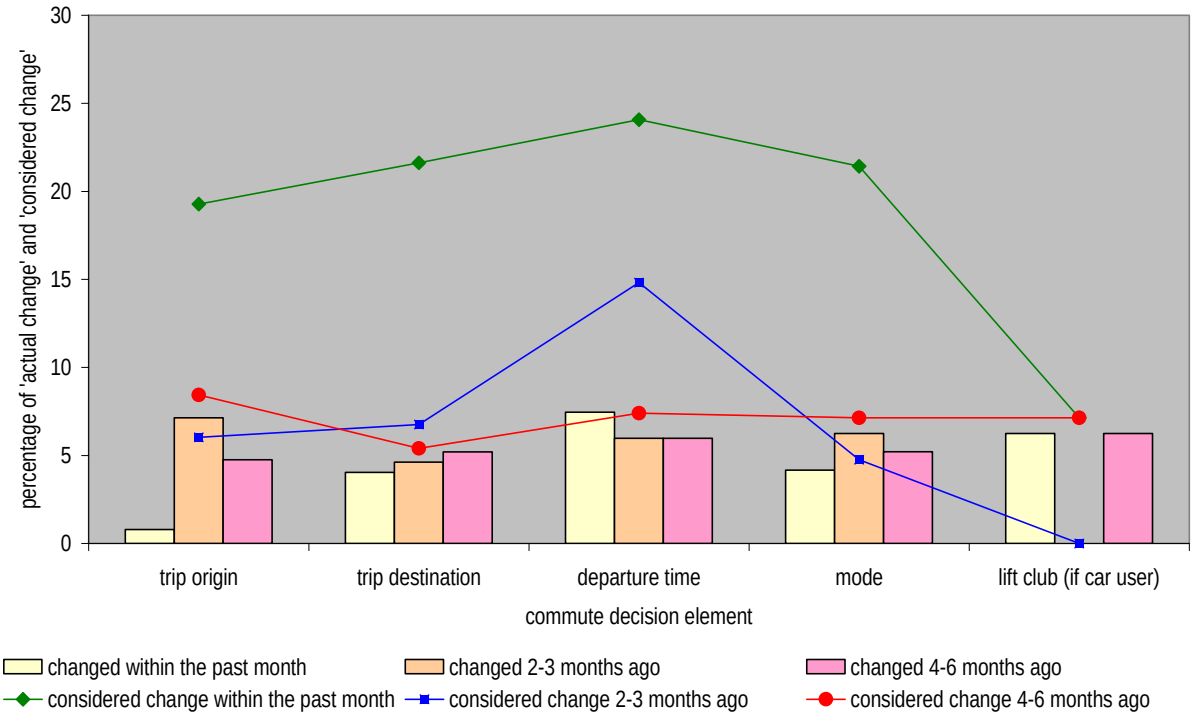

Figure 8: Comparison of time elapsed since 'actual' and 'considered change' in usual behaviour over the previous six months, by (home to work) commute decision element (percentage) (2006, n=250p)

4. CONCLUSION: IMPLICATIONS FOR TDM STRATEGY IMPLEMENTATION

What then are the implications of these findings for TDM strategy implementation? The first obvious implication is that the pace of change following the initiation of TDM strategies can be expected to be slow. The survey findings suggest that changes in commute travel behaviour occur on average in the order of once every 8 to 17 years, depending on which trip decision element is considered. In the absence of a TDM intervention that universally and abruptly changes the generalised cost of single occupancy car travel by a considerable margin over the longer term (e.g. London's congestion charging and Singapore's electronic road pricing schemes), behavioural responses to TDM strategies are likely to occur slowly, at a pace determined by 'churning' changes that are occurring anyway. This conceptualisation of travel choices as habits broken by 'shocks' provides a more robust basis upon which to analyse policy hysteresis generally and behavioural response lags to TDM strategies in particular, and, at least theoretically, provides an explanation for why – as found, for instance, by Fearnley and Bekken (2005) in a review of studies of demand elasticities in the short- and long-term, and by Goodwin (1996) in a review of before-and-after studies of road capacity increases – longer term effects of transport system changes are in the region of one and a half to three times the effects within one year of the system change.

A second implication is that, depending on what trip-making behaviour is being targeted, some TDM measures are likely to have shorter response lags than others, on the grounds that some elements of trip decisions are changing anyway more rapidly than others. While the data analysis is only directional and indicative (as opposed to statistically representative) due to sample size constraints, it shows that TDM measures aimed at changing trip timing behaviour are likely to have shorter term response rates (change occurring in the order of once every 8 years), followed by measures aimed at route choice,

then vehicle occupancy, and in the longer term, mode switching (about once every 10 years), and origin/destination choice (once every 12 to 17 years). This is consistent with the behavioural theories of ‘least effort’, ‘goal setting’ and ’self-regulation’ which underpin the conceptualisation of travel as habitual behaviour (see, for instance, Gärling and Fujii 2006, and Loukopoulos *et al* 2004).

This has potentially important implications for the sequencing of TDM interventions in the strategy formulation process. To satisfy political demands for demonstrable short term impacts, it may be necessary to choose TDM measures with shorter term response rates for implementation in initial phases. Further, if one accepts the TDM mantra of ‘no sticks before carrots’ (i.e. that TDM measures that penalise private car use through, for instance, the imposition of congestion charges or outright prohibition of car use at specified times, should be implemented only once adequate investment has been made to provide acceptable alternative forms of non-motorised or public transport travel), then, while this investment into alternative modes is being made, the initial phases of TDM strategies are best focussed on changing trip timing, route choice and vehicle occupancy, and measures aimed at mode switching are best introduced in later phases. If, however, part of the rationale for measures that levy charges on private motorists is a hypothecation of these revenues for non-motorised and public transport system improvements, the sequencing and ratcheting-up of incentivising and penalising TDM measures requires even more careful consideration.

A third and final implication, following the above, is for the timeframes of TDM strategy monitoring and assessment, and subsequent updating and revision. Obviously if these timeframes are too short – say, one year after implementation – assessments of failure and subsequent abandonment will be premature. It needs to be recognised that fuller impacts of TDM strategies are experienced in five- to ten-year timeframes, and in some instances possibly longer. Assessment of TDM strategies therefore needs to occur over the medium- to long-term.

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